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There was at that time in the theatre an actor named Dorival, thin, lanky, with a weak voice, he had nevertheless a certain amount of success as a tragic actor. "How does that animal manage it?" said Talma to himself. "I am ten times as strong as he is and yet he fatigues himself ten times less than I do. I will ask him what his secret is?" Dorival answered, "Success such as yours, M. Talma, requires no lessons." "I shall find a way of making you give some," said Talma to himself.

So one day, when Dorival was playing Châtillon in *Zaire*, Talma hid himself—where do you think? In the prompter's box, in such a manner as to hear and see without himself being seen. There, crouched up in the darkness, he watches, spies, notices, looks, listens, and after the famous speech in the second act, he emerged exclaiming, "I have it, I have discovered his secret." What then had he discovered? That Dorival's art consisted in knowing how to breathe. Of what did this art consist? In making (I copy one of Talma's own notes) his inhalations before the air in his lungs was entirely exhausted; and in order to conceal from the public these repeated inhalations which would have cut the thread of his speech and even interrupted the flow of sentiment, he inhaled as much as possible before the *a*'s and *e*'s, and *o*'s, that is to say in places when the mouth, already open, allows of slight inhalations, without their being perceptible to the auditors.*

One last remark which is indispensable to the reader. If you wish to inhale and exhale freely, sit on a high chair. Crouched up in an armchair, you could not draw your breath from the very base of the lungs. I would even say, be careful to remain very upright. The man who stoops inhales badly, and exhales badly. Lastly, have a rest for your back as much as possible when reading in public and beginning to feel a slight vocal and cerebral fatigue. I have often been able to ease fatigue by leaning heavily against the back of my chair. Equilibrium is instantly re-established, I inhale freely, and even my head becomes clearer.

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* Many writers say that this is only half the secret. *Inhale through the nose*, with the mouth closed for an instant. To inhale before vowel sounds would be risky for some English readers.

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# ARITHMETIC IN THE NURSERY—AND BEYOND.

### BY FRANCES EPPS.

IN the home where it is an article of faith that "Education is an atmosphere—a Life," one of the first absorbing problems is how best to use and influence the child's nursery days. "Give me the first seven years," pleads the wise and earnest teacher, certain that what he builds on that foundation will stand through all the years that come after.

From the nature of things, these seven years—happy are we if they can be stretched to ten—remain the parents' own blessed opportunity, theirs to arrange and watch over, though later on they may have but little say in the methods by which their children are taught or their application.

It might almost seem that there is no need for further writing on how to begin arithmetic, as there are already hundreds of books on the subject. Still, the interest in all that helps to strengthen and prepare the child for school-life and citizenship—be it hygiene, morals, art, play, first lessons—is ever growing, and also there are still some parents who have yet to forget the methods by which they were taught themselves.

A pathetic, and stimulating memory-picture stands out from the past, of a child bending over a tear-washed slate, "doing" an unexplained long division sum; the pity of it—no joy, no use. Now, though one would fain believe that the growth of sympathetic and rational methods in first teaching has stopped such flagrant "offending" of the little ones as this, yet, as all teachers know, there are still fair little faces turned up to them into which rises a cloud, a dulness, whenever any work with numbers is in hand; and there are still children, in their teens perhaps, who can work sums when set off on a "rule"; who will "try" division, multiplication, reduction, in turns to get the "answer," all because, for want of early training, they have no real grasp of numbers, nor the principles which govern their working.

In the belief that this state of things can be remedied by systematic education in the seven or ten precious nursery years, the following very simple and practical papers are penned; their aim being to foster a mathematical habit and understanding which will influence and strengthen all future work.

The principle which underlies the means employed to carry out this aim is briefly this; to proceed slowly and surely, from the known to the unknown. Therefore, the paths of the ascent are at first of very easy gradient, to let the small climber have the joy of mounting alone with only sufficient effort to strengthen, not fatigue his muscles: if too steep he would slip down, or have to be helped and pushed upwards. The climb is thus made a happy eager one, the daily portion of both mother and child being the pleasure of "something attempted, something done," and done as well as he is able, from the earliest start.

Beginning always with objects, pressing into the service everything that is interesting, the child will pass on slowly as he realises the numbers and their relations, to problems, figures and sums; he will never work with numbers he has not thoroughly apprehended.

In the first stage, twelve instead of the more obvious ten, is his limit, so as to make use of the fact that twelve pence make one shilling; in the next stage he rises to twenty; and then by slow degrees to thirty, sixty, one hundred and twenty, till at last he finishes his course, where his grandparents had to begin, working with abstract thousands and millions.

Again, another part of the plan of work is that all the number relations and processes are unfolded practically and incidentally, together, as the need for using them arises, and as the increasing knowledge of numbers gives more and more scope; the child also learns, in each stage, as he goes along, how to deal with money, measuring and weighing.

While we are still denied the decimal system in England, the fact must be faced that our children have many special difficulties to overcome, and stress is accordingly laid on some of these, such as the double process demanded in all money, and weights and measures sums; the complications in finding true remainders; and in dividing and multiplying by five and a half, thirty and a quarter.

Lastly, remembering always that readiness and accuracy are quite as necessary as knowledge, special attention is given in every stage, to varied repetition and application, and to daily drill for eye, mind and hand, guarding earnestly against any dull and dead routine, any casting of a stumbling-block in the path of our perfect learner, perfect because he is diligent, assiduous, attentive. Diligent—a true lover of his work, because it is interesting and sympathetically unfolded to him; assiduous—sitting steadily and with concentration to "work while he works," because his powers and surroundings are carefully considered; attentive—with mind stretched out to grasp what is before him, because it is within his reach.

With these high aims and hopes in view, we turn to try to set the little feet in the right path, our part being to smooth roughnesses, and encourage effort, as we journey so far together. Soon the day will come when the leader can go no further, but will be content to sit down and watch the now agile climber, as he pursues his way onwards, now in sight, on the beaten track, now plunging independently by untrodden ways in his efforts to reach what is still unknown.

## The Development of the Knowledge of Numbers.

### *From One to Twelve.*

One of the first real conversations a mother has with her baby, is when he has arrived at the stage of sitting strongly upright in her arms, making the tour of nursery or garden, and learning from her lips the names of the things they see together, bird, rose, ball, the easiest words first.

The sparkling eye, the eager, stretched-out, rose-leaf hands; the pretty attempts to repeat the given word, or may be a roguish dumbness ending in the sweetest sound on earth—baby laughter, all these are his answer to the mother's smile and carefully spoken words. Soon he becomes too heavy for much carrying round, and they sit down together at his own comfortable little low table, and quietly handle the brick, the apple, the box, as they say the names.

Presently comes the next stage ; the mother puts one brick, one box, one book, before him, then leads him to discover others exactly similar about the room. These are fetched, put beside those already on the table, and they say together, one brick, another brick, one book, another book, and so on, adding yet another and another, week by week, till there is a row of five or six, to be described as one box, another box, another box—all boxes, and the boy will watch with interest while his mother makes him strings of reels, or chestnuts, to play with, as he says, one reel, another reel, many reels.

After some time the child will be ready to learn the names of the numbers, one brick, two bricks, three bricks, always at first with bricks, boxes, etc., exactly alike before him. The difficulty here will be to keep him back, but care must be taken that he never passes on to a new name in parrot fashion ; he should take months to learn as far as six, and everything that comes within the little one's ken, will be made use of to press home the idea of the number he is learning. Suppose it is four. Having discovered yesterday that he was quite perfect in three, another brick, another box, another reel, was added to those before him, and he counted them several times with his mother. Next morning he finds one more little white swan in his bath, and counts one, two, three, four swans ; smells one, two, three, four roses on the table ; takes four biscuits for his lunch (perhaps gives mother two) ; takes one orange out of the plateful of four ; puts two soldiers beside the other two—four marching in a row ; counts one, two, three, four, as he puts away the bricks, as he throws the pebbles in the pond, as the little feet mount the stairs.

The nursery cupboard is no doubt provided with the good ordinary box of blocks of fair size, and the child can do much useful work in counting, sharing out, putting one on the other, building simple walls and steps, comparing their sizes, putting them neatly away.

A packet of card dominoes, the dots being very distinct, will next give great pleasure. First, the cards bearing not more than six dots will be held up in order (one more dot each time) for the child to learn to say promptly, without counting, how many dots are on the card before him, at first giving them as, three, one ; four, two ; six, blank ; next he will say them " dodging," and then he can be asked to add the three, one ; four, two ; and read off straight, four ; six. The next step will be, when he has said there are five dots on the card, to cover first the three, how many left ? Then the two, now three left, because three and two make or are five. This may seem a very obvious and simple fact, but is nevertheless often a great difficulty to children and may have to be shown over and over again both with objects and dots. The rest of the domino cards will now be brought into use, adding and subtracting up to double six, and when all are readily recognised, the delightful moment has arrived for playing the first simple game of dominoes, that of matching the number of dots. Imagine the happy, important little face playing a real game with father ! and the point is that he will soon play it just as well as his elders, and with just as much chance of winning.

A pack of cards will soon follow, to give variety and practice, both in saying at sight the numbers of pips on the cards, and in simple games such as snap and old maid.

The box of play-money will now be welcomed. First, the child may have and keep in his own little purse, six pennies, six half-pennies, six shillings—one sort of coin at a time—arrange them in rows of two and three ; share them out to the dolls ; learn the names of the three coins ; increase the numbers to twelve ; more arranging and sharing out, and adding and taking away little rows of the coins. If the child's growth allow of it, he can be brought to see what is meant by buying and selling. He can be taken to the corn chandler's and see that a penny will buy some seed for the park sparrows ; two pennies, a pencil for his father ; a shilling, a thimble for nurse ; keeping to the one idea of goods for money, for the present.

The child should now be ready for another step forward—training in remembering numbers ; he can be asked to say from memory something he knows well, such as how many legs has the cat, the bird, the beetle, the round table ; how many persons were at breakfast, how many faces on his treasure crystal, how many sides to his box. Again, he will be shown for a moment or two, three books, five cards, or four pencils, and when they are covered up (one set at a time at first) he will be asked how many cards, books or pencils. Later on this sort of memory game becomes a great favourite, and as many as thirty different objects will be rapidly and correctly written down, after a brief inspection, by children of ten.

The delights of measuring will now give useful employment for many months. Has "the chiel amang us been taking notes" while the dressmaker has been "fitting"? Immediately, with the first available piece of string, the soft little fingers come measuring every part of mother they can reach. Now is the opportunity to slip into the busy hands a wooden foot ruler, and guide them to measure in feet, all the suitable objects in sight; starting perhaps with father's boot. There will be the large table, the small one, the fireguard, the window, the door, and the child will quickly fall into the habit of comparing one width and height with another, his father's height with that of the door, the width of the window seat with that of the arm-chair. Soon noticing the inches marked off on his ruler, he will discover that twelve inches make one foot, and then proceed to measure bricks, boxes, books, by inches. Two more foot rulers can now be given him, also two yard measures, a tape one, and a stick; he will find out that three feet make one yard and measure the mats, the sides of the room, the length of the path; also much happy and profitable time will be spent in measuring off lengths of string, tape and strips of narrow paper. These last can be cut into quite exact inches and feet. It will be found useful to get him to exercise his judgment as to the relative lengths and widths of various objects, and then let him verify by actual measurement, noticing how nearly right he was.

The child will now be ready for further use of the play money. Sixpence will be learned as a new coin, and, with shillings, be changed into pence, and pence into half-pence. Every effort will be made to make him grasp the fact, that only the coins are changed, not the value of the penny, sixpence or shilling. This he may be allowed to make sure of for himself, by seeing two halfpence given for a penny pencil, a shilling packet of paper bought with twelve pence or two sixpences. Brisk business will be carried on in the nursery, buying and selling the toys, contents of work baskets, also yards of tape and string, carefully measured off at a penny or twopence, a yard. At first the exact money must be paid down, but by easy degrees change can be given, a fivepenny needlebook out of sixpence; a sixpenny doll out of a shilling; later, four yards at a penny, change from sixpence; three yards at twopence, change from a shilling. Change, being a difficult idea to children, will need much patient demonstration.

And now, having been successfully trained to realise and work with numbers up to twelve, by means of objects, having counted, played with dominoes and cards, bought and sold with play money, measured with rulers and tape, the child may be carefully led on to abstract work if he shows he is ready for it.

Passing on from rapid addition and subtraction with objects, and then with the dots and pips on the dominoes and playing cards, he can be required to say smartly the answers to questions like the following, for two or three minutes at a time: add two and three; put four and five together; seven and two more; take seven from nine; how many twos in eight; fours in twelve; number of sixpences in a shilling; four yards at twopence; two yards at sixpence, and so on, always going back to illustration with objects if there is any hesitation.

It is a great point in this earliest "mental" arithmetic to use no extra words, and it should also be borne in mind that questions bringing in dolls, hoops, oranges, are often confusing to very young children, who naturally fix their minds on the interesting objects and fail to disentangle the numbers.

If the child has begun to use his pencil, he can now with advantage learn to make the figures which represent the numbers he knows, one figure at a time, till it is really well made, with the number of objects beside him; such as three coins, or four counters, or five shells, as he learns to make the figures on the slate or blackboard. When he has learnt to make and read all the figures, and is absolutely certain of their meaning, he should have two columns drawn in his book, and for daily practice, write out in them, once, as well as he is able, no rubbing out nor second chance, the figures 1 to 12, starting 1 to 9 in the right-hand column, when 10 is reached the 1 is written in the left-hand column, and the 0 below the 9, then

11 and 12 below the 10. The mother will date each effort carefully, and point out improvement, and also let the child read the figures to her in every possible order.

It is also a helpful plan when starting the use of figures, to have dictation from objects, thus: putting out in rows, three, five, nine, books, pencils, bricks, the child will take down the numbers in figures, no words being spoken; this will lead on to his taking down figures from word of mouth, no objects being used.

Pausing a moment to look back over the way we have come, we find that the child has so thoroughly apprehended the first twelve numbers, that he sees them mentally, and can use them with ease. He has also learned to write numbers in figures, and has acquired the first notions of money, and of measuring length. He continues in the next stage, the development of the knowledge of numbers, taking now twelve to twenty.

## STAGE II.

The child has hitherto been learning unconsciously, at play, at any opportunity that offered. He can now have daily definite lessons as well, lasting from five to ten minutes according to his physique and capacity. As one of the chief objects in view at this stage is to strengthen his powers of attention, every effort will be made that these lessons shall be in order, regular, and uninterrupted. The little one will be proud to see his name appear on the Nursery Time Table, perhaps for five minutes at nine o'clock, for brisk mental drill; then, as best suits nursery arrangements, provided he is at his freshest, for ten minutes, his the lesson of the day, when the business in hand will be to increase, slowly, the knowledge of numbers from twelve to twenty, continuing, as he goes along, the money tables, and gaining the first ideas of weight. Later in the day, he can have five or ten minutes practice in written work.

The methods of teaching the new numbers will be on the lines of those used for the earlier ones. Counters, shells, beans will be arranged on the table, ten in a row, or in two rows or groups of five, and at a little distance, the three, four, five, that go to make, with the ten, the new number to be learnt; fourteen, for instance, will be explained as four and ten more; and when this first aspect of the number is quite understood, the beans and shells can be arranged in rows as fourteen ones, seven twos, two sevens. Next every mode of presenting it will be tried: "Here are six cards, how many must we add to make fourteen; here are fourteen beans, take away seven how many left, and how many must you put back to have fourteen again; I have threaded five large beads on this wire, make them up to fourteen, how many?" and so on. The domino and playing cards will also be used, those with ten on the face—two fives, six and four, three and seven, eight and two; then those with three, four, and so on, held up beside the ten, to make the number under consideration. The child's strings of chestnuts, reels, large beads, will be added to, as he knows yet one more, and one more.

When working with even numbers and with fifteen, much practice will be given in setting out the counters, bricks, beans, in rows of two, four, three, five, etc., and the child may be taught to say, as he does it, two twos in four; three fours in twelve; three fives in fifteen: he may also be given a tray of counters, twelve, sixteen, twenty, to find out and arrange the threes, fours, fives in each collection.

The copper and silver coins he already knows from the play money, will be increased in number, lesson by lesson, to twenty; arranging thirteen pennies neatly on the table, he will show they are worth as much as, or are equal to, one shilling piece and one penny, and so on up to twenty pennies; he can also be introduced to two, four, five shilling pieces, and the two gold coins. Each new coin will be well looked at, its size traced on paper, its diameter measured, different sizes and colours will be noticed and explained, and much practice will be given in changing backwards and forwards, two shillings for a florin, a half sovereign for ten shillings, four crowns for a sovereign, all in endless variety. All this is the subject matter of the mid-day lesson.

Turning now to the short mental drill of each morning the child will add and subtract rapidly as before, using each number as learnt. Next, with the coins before him at first, later without them, he may be asked, how many sixpences in a shilling, pennies in sixpence, sixpences in two shillings, five shilling pieces in half sovereign, and so on. Later, when quite ready for it, questions involving two mental processes will be asked: add two and three, take away one; two yards at a penny, how much change out of fourpence; three for you, three for me, how many left out of nine; and so on, always avoiding unnecessary words, and always going back to the use of objects if there is any hesitation.

To pass on to the daily writing practice. The board or slate will be used as before, to show how to write the new numbers, and the child himself will do his first practice on it. The double columns will be headed by the words tens, ones, the figures written in them as before. When 10 is reached, it must be made clear that the 1 in the tens' place or house means ten ones, or one ten, and that the 0 in the ones' place, means that in 10 there is exactly the one ten, or the ten ones, and that there are no ones to put in that column. Next in 11, 12, besides the one ten, the child must see that there is one 1, 2, to put down in the ones' place, leading him to remember that ten and one make or are eleven, ten and two are twelve. He must realise for himself, little by little, the meaning of local value, the chief help his teacher can give him being, to state the case slowly and carefully, and then avoid confusing him with too much explanation and illustration. Daily deliberate writing in columns as far as he has learnt, with frequent dictation as before, will do much to prevent him, later on, confusing 12 and 21, 35 and 53. Having learnt the money table from the coins, and the use of the sign = (equals), the child can add to his daily writing practice the pence table up to twenty.

All the time that these definite lessons are carried on, the daily nursery life will still afford its countless opportunities for interesting and helpful work and play. Practice in buying and selling in the nursery market will go on with re-doubled vigour owing to increased floating capital, especially as, the number sixteen being reached, the scales will be brought up and all sorts of weighing in ounces and pounds, of books, balls, apples, potatoes, sand, bran, rice, will be carried on with delightful energy. The games, already very popular when resting after singing and dancing, can be extended. Matador dominoes, in which the basis of operations is the number seven, should now be found quite easy and interesting, also backgammon and the simplest form of patience.

The memory game too, can be followed up, using, as more numbers have been learnt, more of the same kind of objects, and then a few different ones; soon this can be varied by writing one or more figures on a board or slate, wiping them off when well looked at, and then seeing who can remember best what they were.

Another stage of the climb over, we look back to see what has been accomplished so far. Numbers up to twenty have been so thoroughly grasped, that mental addition, subtraction and multiplication, within the limit, can be successfully done. The child can also express these numbers in good figures, and has gained the first ideas of local value. The knowledge of how to use money and measures has grown, and first ideas of weight have been implanted. Memory for numbers has been cultivated, also the power to play games well. He has also learned to sit still, and work for ten minutes at a time.